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(71) Applicant (for all designated States except US): NES-  
TLE WATERS MANAGEMENT & TECHNOL-  
OGY [FR/FR]; 20, rue Rouget de Lisle, F-92130  
Issy-les-Moulineaux (FR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DURAND, Cyrille**

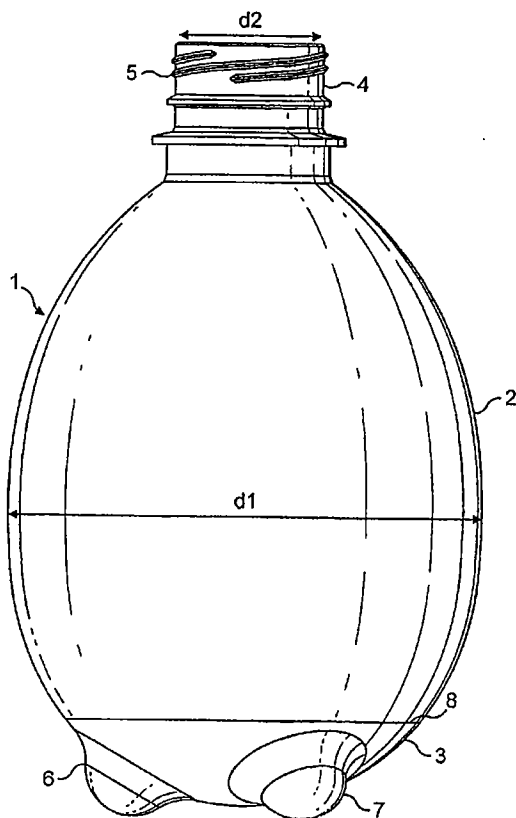
[FR/FR]; 57, rue du Luxembourg, F-88800 Vittel (FR).  
**DENIS, Gérard** [FR/FR]; 1bis, rue Jules Hansen, F-51100  
Reims (FR). **CONTAL, Alain** [FR/CH]; Route du Jorat  
142, Vers-chez-les Blanc, ch-1000 Lausanne 26 (CH).  
**ROULIN, Anne** [CH/FR]; Rue St-Nicolas 402, F-88800  
Vittel (FR).

(74) Agent: **THOMAS, Alain**; Avenue Nestlé, 55, CH-1800  
Vevey (CH).

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[Continued on next page]

(54) Title: A CONTAINER FOR PRODUCT WITH LESS PACKAGING MATERIAL



(57) Abstract: The invention concerns a container comprising  
a body (1) formed by walls (2) and a bottom (3), having in his  
greater section a dimension  $d_1$  and a neck (4) with an internal  
diameter  $d_2$ , said container being made from a semicrystalline  
PET, the body of said container comprising at its bottom at  
least three feet spaced from each other and being integral with  
said body, wherein for the body, the ratio weight of the walls on  
weight of the bottom is comprised between 3 and 4 and wherein  
the ratio volume of the body of the container, expressed in ml,  
per gram of PET of the body is comprised between 80 and 120.



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**A container for product with less packaging material.**

The present invention relates to the field of the packaging of flowable products such as liquids or pasty products, particularly that of containers intended to contain beverages and more especially mineral water.

One topic in the packaging area, especially for water is to reduce the weight of the plastic material used, and more particularly to reduce the weight of the bottom of the container. By reducing the weight of the bottom, the first danger is that said bottom is less resistant because of the fact that the bottom is really the part of the container, which is the more submitted to constraints, due to the contact of said bottom with the place where it is disposed. There are already some solutions to that problem, like the container with petaloid bottom: the FR Patent No. 2772720 concerns such a container, wherein the bottom is thinner. Although this patent brings a solution for the bottom, it remains a container with a too high amount of plastic material for the volume of the product filled in said container.

The objective of the present invention is to have a container for a flowable product with a bottom allowing said container to stand and which for the same volume requires less plastic than a standard container while at the same time having comparable or higher mechanical properties.

The subject of the present invention is a container comprising a body formed by walls and a bottom having in his greater section a dimension  $d_1$  and a neck with an internal diameter  $d_2$ , said container being made from a semi-crystalline PET, the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the

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bottom is comprised between 3 and 4 and wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 80 and 120. The volume is given in ml.

5

Under bottom in the present description, we understand all the part of the body comprising the space of said body outside the feet, said feet being taken from their most external position. Under body, we understand the container without the neck. Concerning the ratio weight of the walls on weight of the bottom, for bottles on the market, like a 150 cl bottle, the ratio is 31.5g:10.5g (3), for a 50 cl bottle, the ratio is 12.2:3.3 (3.5) and finally for a 1 l bottle, the ratio is 25.70:6.80 (3.78).

15

Semi-crystalline PET means in the present specification a PET having a crystallinity comprised between 10 and 60 %. More preferably, the crystallinity is comprised between 20 and 40 %.

20

One specificity of the invention is that the container has feet at the bottom, which are integral with said body. The presence of three feet is a good solution, but for greater volume a presence of 4 or 5 feet is preferred. The geometry of said feet is not critical. Preferably, these feet have a spherical geometry. Concerning the bottom of the container, it has preferably a non flat form. The bottom has a convex form, like a semi-spherical form.

30

It is possible for the container of the invention, either to have a neck with a small height, like a couple of millimeters, or to have a neck with a greater height. In this case, the ratio height of the neck on the height of the body is comprised between 1:1 and 1:4. This allows for the consumer a better gripping of said container.

35

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Preferably, the walls of the body have a thickness of less than 100  $\mu\text{m}$ . The neck of the container has preferably a wall thickness comprised between 150 and 250  $\mu\text{m}$ . Each foot of the bottom of the body has a thickness  
5 comprised between 50 and 150  $\mu\text{m}$ .

In the container of the invention, the part of the bottom between the feet has a greater thickness of that of the walls, for example around 100-200  $\mu\text{m}$ .  
10

The present invention concerns further a packaging assembly comprising  
- a container comprising a body formed by walls having in his greater section a dimension  $d_1$  and a neck with an  
15 internal diameter  $d_2$ , said container being made from a semi-crystalline PET, the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the  
20 bottom is comprised between 3 and 4 and wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 80 and 120,  
- a product in the container and  
- closing means for closing off or distributing the  
25 product from the neck,  
the filled container being substantially incompressible by hand when filled with the product.

This incompressibility applies for all types of products,  
30 even for a still product. In the present specification, incompressible means that when squeezed the filled container only deforms very slightly and then will recover its original shape. In contrast, a standard bottle will buckle and deform. It is also possible  
35 according to the invention to have a gasing of the head space, for example at a relative pressure comprised between 0.2 and 1.5 bar. Preferably, the head space is

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gassed at a relative pressure comprised between 0.4 and 0.7 bar. The gas used is nitrogen or carbon dioxide.

According to a feature of the invention, the container  
5 comprises on its outside a printing made by pad printing. The advantage of this solution, is that it suppresses the need of having a paper stuck around the container.

The volume of the container used according to the  
10 invention can have all type of capacity, comprised between 5 cl and 20 l capacity. The container is intended to contain all type of product, like pasty, liquid, semi-liquid, granular or powdered product. Under liquid  
15 product, we understand water or a still liquid beverage, particularly still mineral waters, carbonated water or a carbonated liquid beverage, particularly sparkling  
mineral water. Other types of liquid products are also possible, like chemical products, oil, essence, perfumes, pharmaceutical products. Under pasty products, we  
20 understand food and non food products, like mayonnaise, cosmetic compounds and others.

The means of closing are either a cap, or sealed  
membrane. The caps can be used for any diameter of  
25 opening of the neck. On the contrary, the sealed membranes are preferred with smaller diameter of the neck, for example in the area of 10 mm. In this case, the container can support high compressions, for example  
by the storage and by the transportation. For diameters  
30 of around 10 mm, the container can support an internal pressure of the order of 5 bar. It is also possible to close the container by sealing or welding the neck, wherein a cutting object or similar is provided for the opening.

35

As a preference, the container has an ovoid or substantially ovoid overall shape. This natural shape derived from an egg represents a structure whose

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resistance to vertical and/or transversal loads is optimized, thus making it possible, for a given volume and a given amount of material, to achieve mechanical properties which are equivalent to or even better than  
5 the cylindrical or roughly cylindrical shapes customarily encountered in this domain.

In another embodiment, the container according to the invention has a three dimensional shape convenient for  
10 gripping, a spherical, substantially spherical or cylindrical overall shape.

This is because the geometry with symmetry of revolution is particularly easy and therefore economical to  
15 manufacture and has the advantage of allowing the container to be filled with products which can emit gaseous substances, such as carbonated beverages (sparkling waters, sodas, etc.) in particular, which are widely consumed worldwide these days. Such a shape is  
20 therefore particularly well suited to these liquids in that the release of carbon dioxide or other gas has a tendency to deform the bodies of bottles which do not have symmetry of revolution, having a negative impact on their stability, grasp and ease of handling, appearance,  
25 etc.

In a preferred feature of the invention, the ratio  $d_2$  on  $d_1$  of the container is comprised between 1:3 and 1:10. According to a preferred embodiment of the packaging  
30 assembly, the ratio weight of the walls on weight of the bottom is comprised between 3.4 and 3.8. According to a further preferred feature of the invention, the ratio volume of the body of the container per gram of PET of the body is comprised between 90 and 110.

35

According to another feature, the plastic used to form the wall or walls is a semicrystalline plastic with a slow rate of crystallization, the glass transition

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temperature ( $T_g$ ) of which is 70°C or higher and the  
crystallisation temperature  $T_c$  is around 140 °C.  
A slow rate of crystallization is to be understood as  
meaning a rate which makes it possible to have an  
5 amorphous state by quick cooling.

Advantageously, the plastic used to form the wall or  
walls is chosen from the group formed by PET  
(polyethylene terephthalate) and PEN (polyethylene  
10 naphthalate). It has been noted that the drawing of the  
PET has no negative influence on the water barrier  
properties of the obtained container and that also a  
thickness of around 50  $\mu\text{m}$  and less guarantees a good  
safety of the container itself and of the storage.  
15 In order to guarantee both the flexibility needed for the  
aforementioned deformation and sufficient mechanical  
strength, the container according to the invention is  
further characterized in that the thickness of the wall  
or walls forming the body of the container is between  
20 30  $\mu\text{m}$  and 100  $\mu\text{m}$ , preferably between 50  $\mu\text{m}$  and 70  $\mu\text{m}$ .  
As already mentioned, small thicker areas or portions of  
walls may also be provided on the body of the said  
container, particularly in close proximity to the neck  
and/or the bottom, so as to reinforce these parts  
25 locally. Such reinforcements may in particular be useful  
to facilitate the filling of the said containers or to  
increase their stability during storage.  
As a preference, the container is further characterized  
in that the body and the neck of the container are made  
30 as a single piece. This makes it possible to avoid any  
join or weld which may constitute a region of greater  
weakness.

Indeed, according to another feature, the container  
35 according to the invention is characterized in that, it  
has a high resistance to vertical and/or transverse loads  
allowing good resistance to transportation. For example,  
for a working volume of 5 litres, the amount of PET used



to produce the said container is about 30 g. for resistance to a vertical load of about 65 kg. This represents a significant saving in plastic, the few 5-litre containers that are currently on the market requiring an amount of polymer which, for comparable mechanical strength, is over two times greater than the amount needed to manufacture a container according to the present invention. When containers of lower volumes are used, for example of the order of 33 cl, the quantity of plastic material is of the order of 3-4 g, in comparison with a bottle of the same volume, wherein the amount of plastic is of the order of at least 12 g. This type of container supports a vertical loading of more than about 100 kg. That the container supports a vertical or transverse loading means that the weight given does not deteriorate the package integrity, that is does not lead to a risk of breaking said container.

These simple shapes also allow the container according to the invention to be used as a refill or recharge for water coolers, for which a flat bottom is not necessary, these refills generally being used by inserting the container, head (neck) downmost, into the accommodation device of the said water cooler. In addition, this type of surface geometry also makes it possible to increase the area of heat exchange between the said container and the chilling device usually present in the said water coolers.

According to another alternative form, the container according to the invention is characterized in that the neck is fitted with a closure and/or distribution means produced in the form of a distribution tap which can be operated with one hand.

Such distribution taps, which are known per se, advantageously allow the distribution of the flowable product contained in the container to be regulated in a

particularly convenient way, for example when this container is stored horizontally on the shelves of a refrigerator, the other hand holding the container into which the said flowable product is to be transferred, for  
5 example with a view to consuming it.

Because of its flexible nature, the geometry of the container can also adapt more readily to that of the storage place, as opposed to the rigid cans currently available which need to observe very specified dimensions  
10 in order to be able to be stored in restricted spaces such as the internal compartments of refrigerators. In addition, the space freed as a container according to the invention is emptied can also be put to use for storing objects the size or shape of which can vary, which is not  
15 the case with rigid containers in which the volume of liquid removed is systematically replaced with air. In this type of container, the volume initially occupied remains so until the empty container is removed from the refrigerator.

20 Another subject of the present invention is the use of the container by way of large-capacity, at least 5-litre capacity, container intended to contain water or a still liquid beverage, particularly still mineral water.

25 Another subject of the present invention is the use of the container according to the invention by way of large-capacity, at least 5-litre capacity, container intended to contain carbonated water or a carbonated liquid beverage, particularly sparkling mineral water.

30 Of course, the containers of the present invention are not in any way limited to flat or sparkling mineral waters but can be intended to contain all sorts of flowable products, edible or inedible liquids of greater or lesser fluidity such as, for example, fruit juices,  
35 milk-based beverages, etc., and also sauces or condiments (ketchup, mustard, dressing, etc.) or non-food liquids (deionized water, cleaning products, detergents, etc.).

The packaging assembly according to the invention can also contain a functional component. The functional component is taken from the group consisting of a fibre, plant extract, fruit extracts, vitamins and flavors. The assembly is pasteurised or sterilised at a temperature in excess of 60 °C.

Finally, another subject of the present invention is a method for manufacturing a body of a container according to the invention, characterized in that the said body is obtained by stretch blow forming of a PET preform with high stretch index in comparison with the classical stretching of a preform. The blow forming can be also a blow molding. Compared with the blowing of plastic bottles, wherein the blowing pressure is comprised between 30 and 40 bar, according to the process of the invention, it is sufficient to blow at a pressure of around 2 times less. This reduces the cost of the process and also of the machine which is used. Concerning the stretch index, it is depending of the volume of the final container. For example, in the case of a container having a volume of less than 100cl, the stretch index is between 100 and 300 cm. In the case of a container having a volume of 500 to 1000 cl, the stretch index is comprised between 500 and 700 cm. In the case of container having volume of 2000 cl or more, the stretch index is around and more than 1000 cm.

The stretch index is defined as follows :

$$\text{Stretch index} = \frac{\text{internal volume of the stretched container}^*}{\text{internal volume of the preform before stretching}^*} \times \frac{1}{f}$$

$$f = \frac{\text{internal surface of the container}^*}{\text{internal volume of the stretched container}^*} \quad (\text{cm}^{-1})$$

\* with the exclusion of the neck

In the embodiments of the containers according to the invention, for volumes of 33 cl, 1 liter, 5 l, 10 l and 20 l, the different ratios S2 on S1 are comprised between 1:4.5 and 1:15.

5

Because of the substantial incompressibility of the filled container of the invention, there is no need to have reinforcing structures. The consequence is that it is possible to have simple shapes, which have the advantage of providing transparency and purity. This is particularly important for the consumer in the case of a container for drinking water. Another advantage of this container is that it can be emptied without air coming in and this reduces the risk of contamination or odours entering the product that may cause taste changes or degradation.

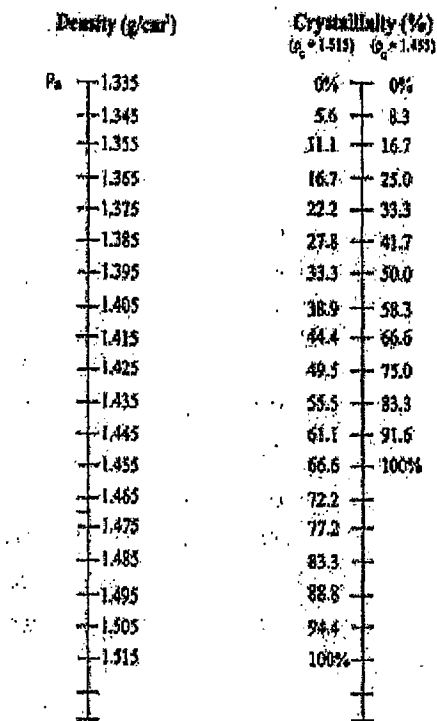
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15

The measure of the crystallinity is made on a density column from Lloyd-Davenport, according to following procedure. The column is filled with a salted solution (calcium nitrate) having a density gradient. The column is calibrated with balls having known density between 1.335 and 1.455. Then small pieces of the container of the invention are immersed in the column and after a certain time, they stay at a certain height of the column corresponding to a certain density. The measures are made at 23 °C. The following correspondance table with  $\rho_c$  of 1.455 gives the cristallinity

20

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Other features and advantages of the invention will become apparent from the description which follows, given by way of example and with reference to the appended drawings in which:

Fig. 1 is a lateral perspective view of the container according to the invention,

Fig. 2 is another perspective view of the container of the invention, seen from the bottom and

Fig. 3 is a graph comparing the invention with the state of the art.

In the embodiment described and depicted on figures 1 and 2, the container for a flowable product, particularly for a beverage and, in particular, for mineral water, essentially consists of a body 1, formed by walls 2 and a

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bottom 3 and a neck 4. The body is made of a semi-crystalline PET. The neck presents a screw 5 for receiving a cap (not shown). The bottom 3 presents three feet 6 integral with the body. The volume of the container is of 1000 ml. In this specific example the ratio weight of the walls on weight of the bottom is of 3.5 and the ratio volume of the body of the container per gram of PET is of 100. This means that for the volume of 1000 ml, there is 10 g of PET for the body (neck excluded). The thickness of the walls is around 70  $\mu\text{m}$ . The neck has a height which is minimised and said neck has a wall thickness of around 200  $\mu\text{m}$ . In the area 7 of the feet, that means around the middle of said feet, the wall thickness is around 150  $\mu\text{m}$ . The feet have a semi-spherical shape. Concerning now the limits of the wall and bottom for calculating the ratio weight of the walls on weight of the bottom, it is outside and inside of the circle 8 of figure 2.

Concerning now the graph of figure 3, the x axis represents the volume of the container in ml and the y axis represents the ratio volume of the container in ml per g of the plastic material of said container. The graph 1 shows a bottle used on the market for sparkling water. The graph 2 shows a bottle used on the market for still water and the graph 3 shows a container according to the invention. This graph shows very clearly one of the specificity of the invention, which is that less plastic material is needed for conditioning the same volume of product. Taking an example of the graph : according to the invention 1 g of plastic material is needed for 100 ml of product, whereas for products now on the market 1 g of plastic material is needed for only around 40 to 60 ml of product. That means that according to the invention, the need of plastic material is divided by 2.

**Claims.**

- 1) A container comprising a body formed by walls and a bottom having in his greater section a dimension  $d_1$  and a neck with an internal diameter  $d_2$  , said container being made from a semi-crystalline PET , the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the bottom is comprised between 3 and 4 and wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 80 and 120.
- 2) A container according to claim 1, wherein the walls of the body have a thickness of less than 100  $\mu\text{m}$ .
- 3) A container according to any of claims 1 or 2, wherein the neck has a wall thickness comprised between 150 and 250  $\mu\text{m}$ .
- 4) A container according to any of claims 1 to 3, wherein each foot has a wall thickness comprised between 50 and 150  $\mu\text{m}$ .
- 5) A container according to any of claims 1 to 4, wherein the part of the bottom between the feet has a greater thickness of that of the walls.
- 6) A packaging assembly comprising
- a container comprising a body formed by walls having in his greater section a dimension  $d_1$  and a neck with an internal diameter  $d_2$  , said container being made from a semi-crystalline PET , the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the bottom is comprised between 3 and 4 and wherein the ratio

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- volume of the body of the container per gram of PET of the body is comprised between 80 and 120,  
- a product in the container and  
- closing means for closing off or distributing the  
5 product from the neck,  
the filled container being substantially incompressible by hand when filled with the product.
- 7) A packaging assembly according to claim 6, wherein the  
10 product is taken from the group consisting of pasty, liquid, semi-liquid, granular or powdered product.
- 8) A packaging assembly according to any of claims 6 or 7, wherein said assembly has a high resistance to  
15 vertical and/or transverse loads allowing good resistance to transportation.
- 9) A packaging assembly according to claim 8, wherein said assembly supports a vertical and/or transverse  
20 loading of more than about 100 kg for a container having a weight of about 4 g.
- 10) A packaging assembly according to any of claims 4 to 9, wherein the body of the container has a form taken  
25 from the group consisting of a three dimensional shape convenient for gripping, an ovoid, spherical, elliptical or cylindrical shape.
- 11) A packaging assembly according to any of claims 4 to  
30 10, wherein the wall thickness of the body, substantially in the middle of its body is comprised between 30 and 70  $\mu\text{m}$ .
- 12) A packaging assembly according to any of claims 4 to  
35 11, wherein the container comprises on its outside a printing made by pad printing.



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- 13) A packaging assembly according to any of claims 4 to 12, wherein the ratio  $d_2$  on  $d_1$  is comprised between 1:3 and 1:10.
- 5 14) A packaging assembly according to any of claims 4 to 13, wherein the ratio height of the neck on the height of the body is comprised between 1:1 and 1:4.
- 10 15) A packaging assembly according to any of claims 4 to 14, the ratio weight of the walls on weight of the bottom is comprised between 3.4 and 3.8.
- 15 16) A packaging assembly according to any of claims 4 to 15, wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 90 and 110.
- 20 17) A process for manufacturing the container according to any of claims 1 to 5, wherein said container is obtained by stretch blow forming of a PET preform with high stretch index in comparison with the classical stretching of a preform.

1 / 3

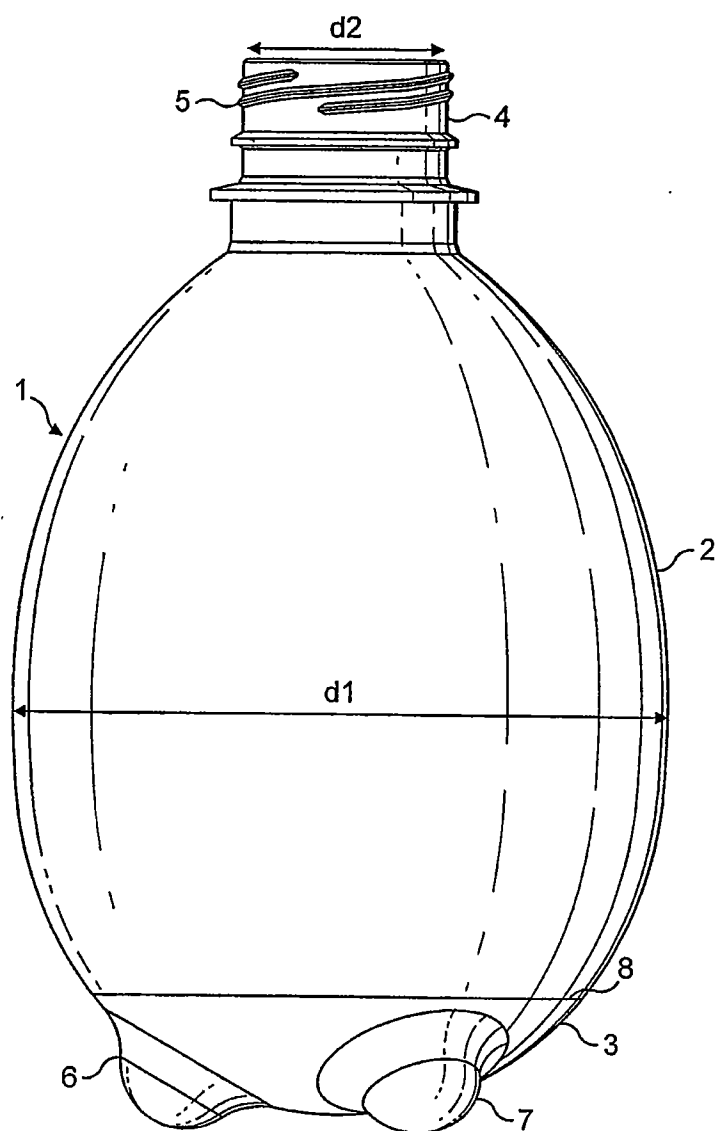


FIG. 1

2 / 3

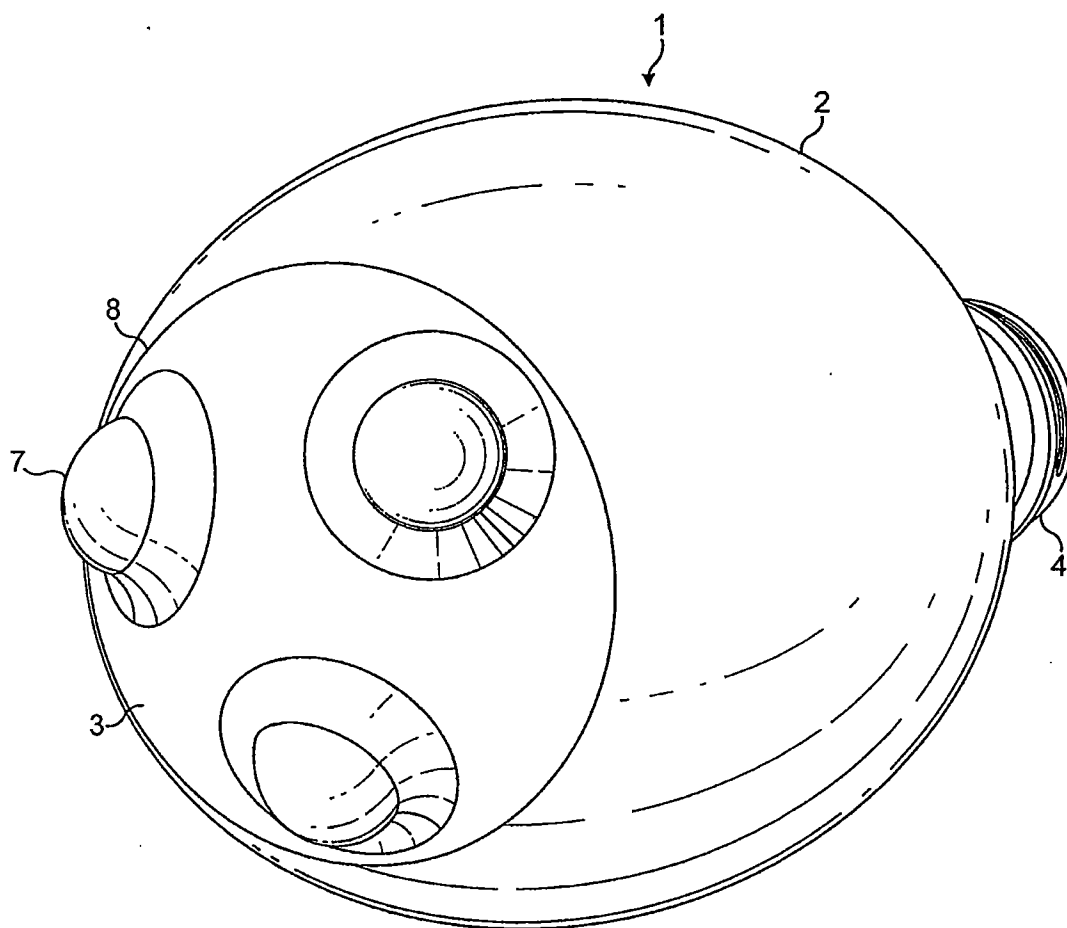


FIG. 2

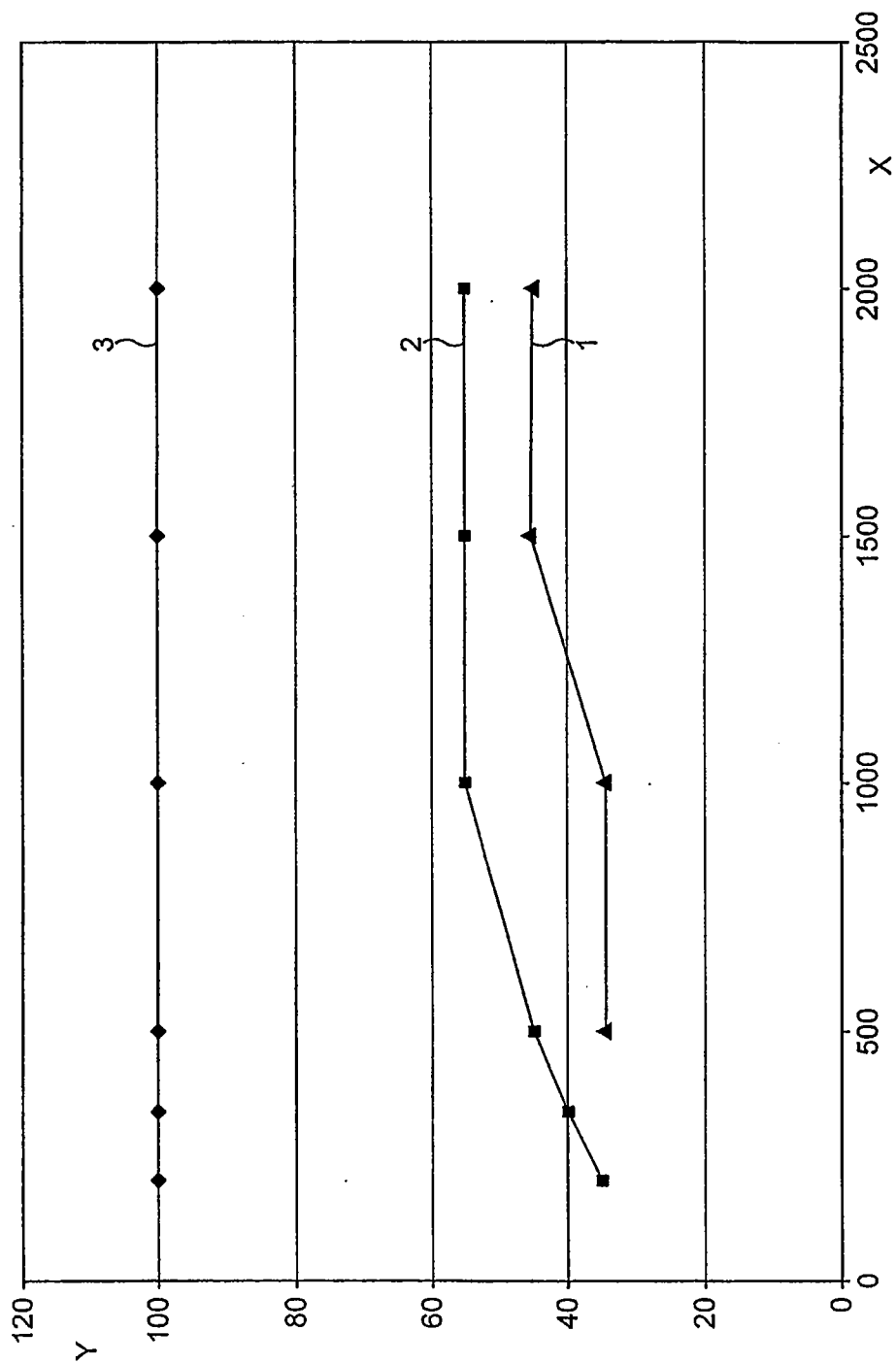


FIG. 3

# INTERNATIONAL SEARCH REPORT

International Application No  
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**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B65D1/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 830 844 A (PERRIER VITTEL MAN ET TECHNOLO) 18 April 2003 (2003-04-18) the whole document	1-17
A	US 3 733 309 A (ROSEVEARE R ET AL) 15 May 1973 (1973-05-15) claim 1	1,6,17
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☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

28 January 2005

Date of mailing of the international search report

04/02/2005

Name and mailing address of the ISA

European Patent Office, P.B. 6818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Bridault, A

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: -

The claims relate to a container defined inter alia by reference to the following parameter:

ratio weight of the walls over weight of the bottom.

The use of this parameter in the present context is considered to lead to a lack of clarity within the meaning of Article 6 PCT. It is impossible to compare the parameter the applicant has chosen to employ with what is set out in the prior art, since the parameter is not used in the prior art. Moreover, the value claimed for this parameter can result from different factors, such as the relative thicknesses or the relative extent (surface area) of the bottom and walls. The lack of clarity is such as to render a meaningful complete search impossible. Consequently, the search has been performed while disregarding this parameter, and focused instead on containers with a thin bottom.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/EP2004/011606

### Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

#### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/011606

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